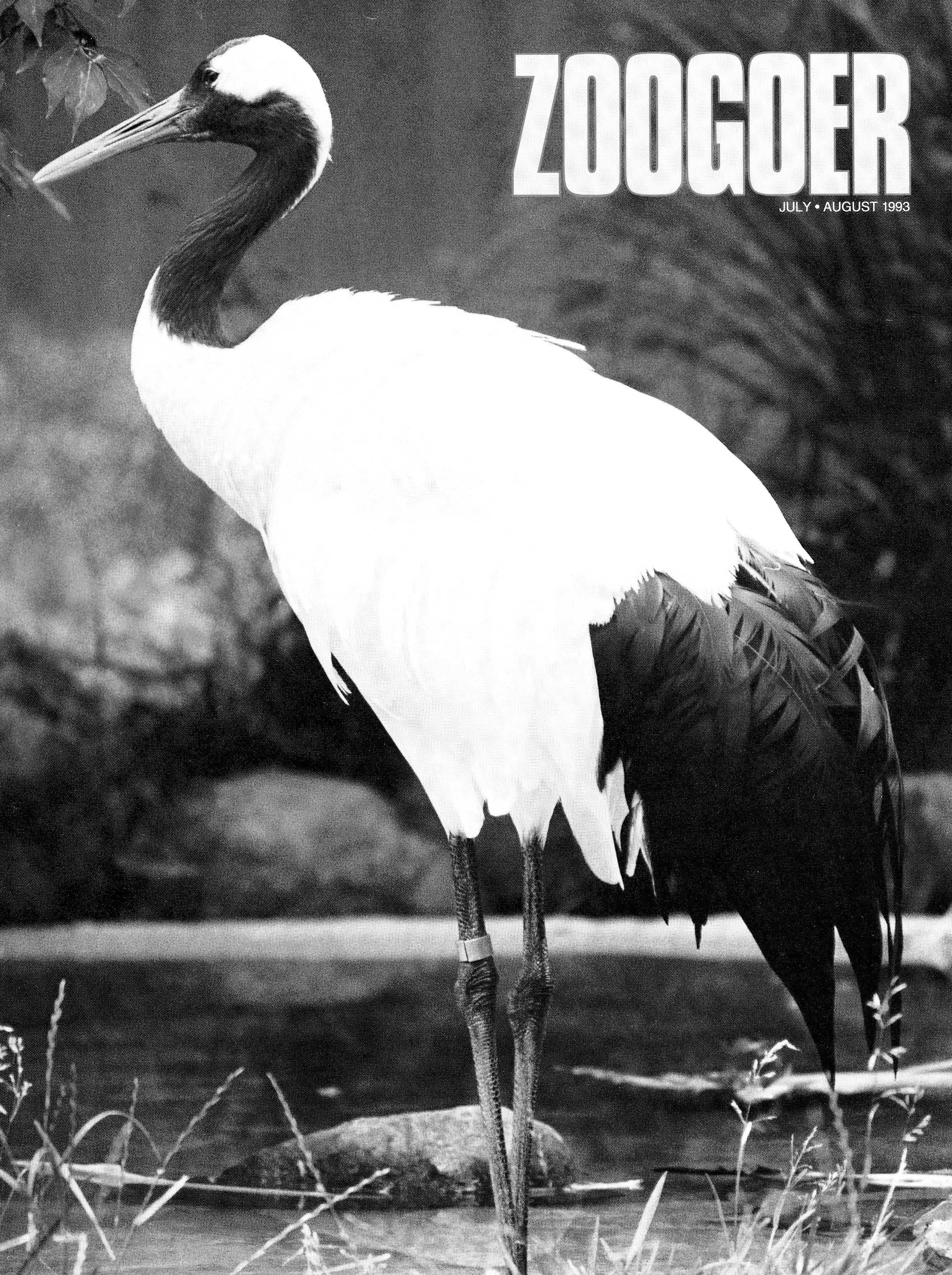
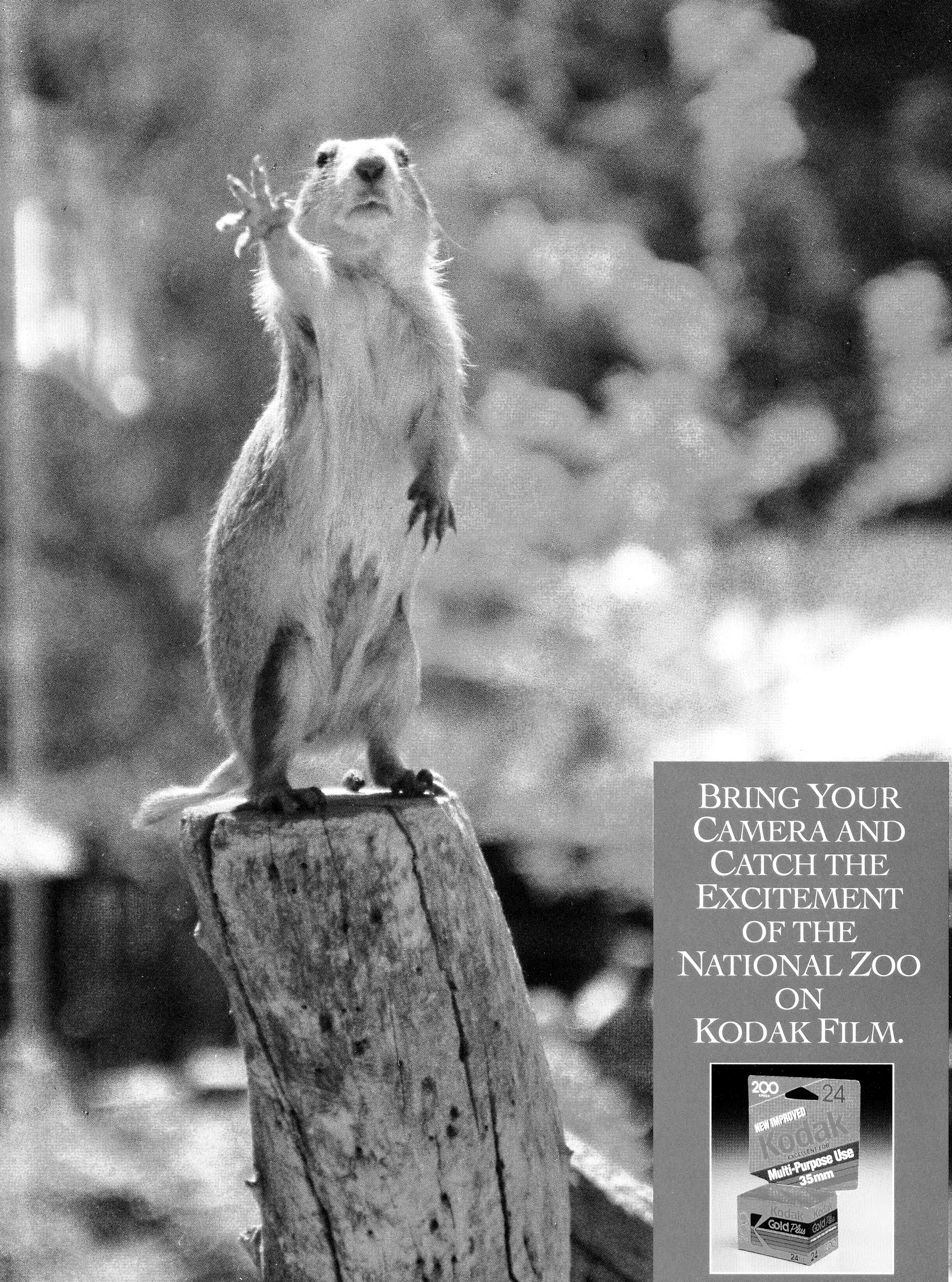


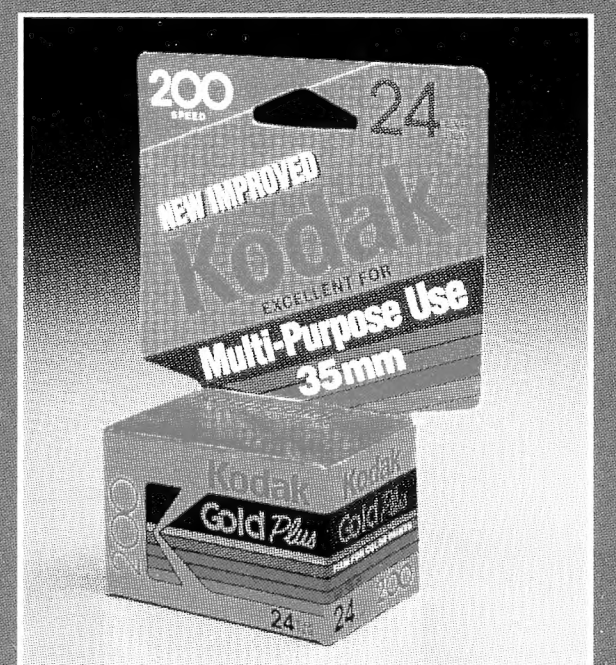
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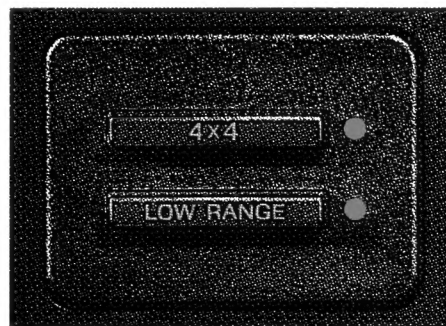
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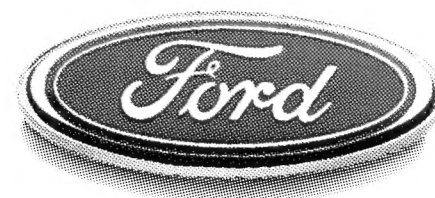


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(Jessie Cohen/NZP)

ZooFari Results

ZooFari 1993 can only be described in superlatives: From the fabulous food and the marvelous music to our high-spirited guests and hardworking volunteers, the whole Shebang was splendid—and a resounding success. Orang Shebang raised more than \$190,000 for the Theodore Reed Animal Fund, a 15-percent increase over 1992's ZooFari and a whopping 170-percent increase over 1988, when FONZ first introduced the current ZooFari format.

Part of ZooFari's success is directly attributable to FONZ members, who bought more tickets and tables than ever before. In fact, more than half of the event's proceeds came from FONZ members. But ZooFari also enjoyed more—and more diverse—community and corporate support than ever before.

The Coca-Cola Company once again generously underwrote some of the costs of ZooFari, while our friends and neighbors at Calvert Woodley Wine

& Liquors and the Omni Shoreham Hotel made very generous in-kind contributions, and artist Jane Gaston graciously donated her original *Orangs* art.

New benefactors in 1993 included Black Entertainment Television, which contributed sound, stage, lights, and an announcer for headline entertainer Chuck Jackson, as well as a film crew to record the event; Coors



Don Naylor

Clint Fields (right) and his wife Elaine enjoying ZooFari with Redskins wide receiver Desmond Howard (middle left) and Black Entertainment Television's Curtis Symonds (middle right).

Light, which sponsored Chuck Jackson's performance; and Piper Sonoma, which donated sparkling wine. The Purina Big Cat Survival Fund and the Golden Cat Corporation offered corporate support.

Five area radio stations—WCXR, WGMS, WKYS, WMAL, and WXTR—representing formats from classic rock and classical to urban contemporary, talk, and oldies, gave ZooFari massive publicity and sent their personalities to help at the event. And, of course, 72 restaurants and 10 performing groups contributed that fabulous food and marvelous music.

This all means that ZooFari is achieving a goal that is as important as the bottom line: making friends for FONZ and the Zoo and raising widespread community awareness about the need to conserve biological diversity and protect the environment.

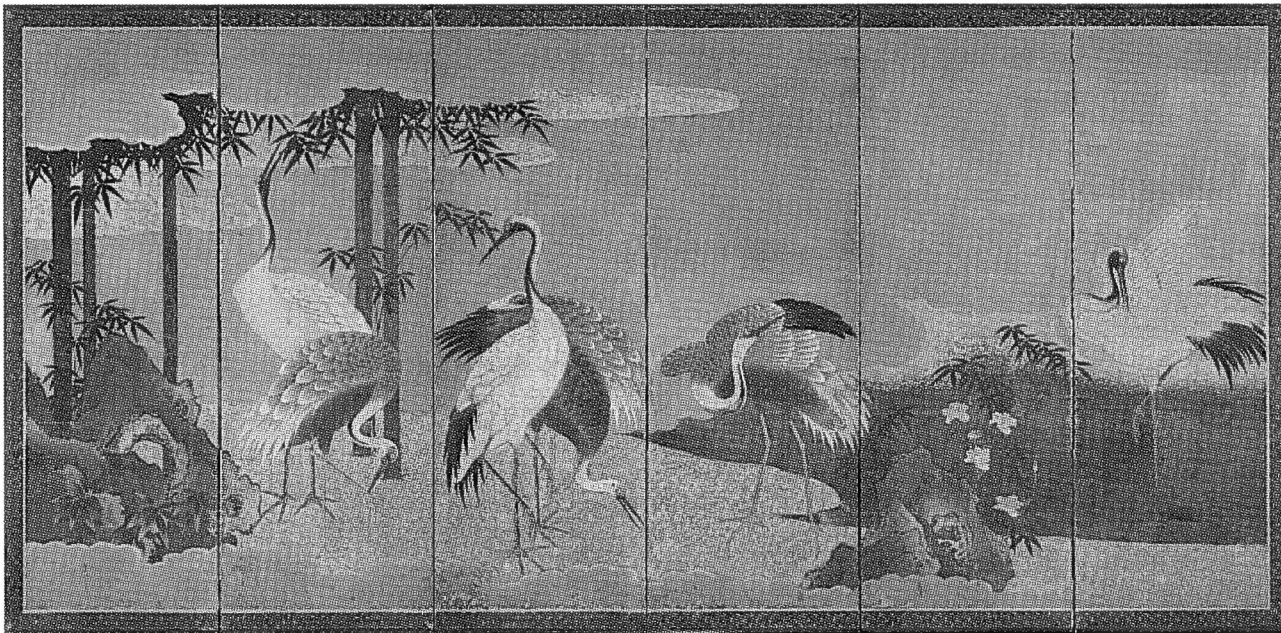
To all who contributed, to all who attended, and to all who worked, thank you for making Orang Shebang the biggest and best ZooFari ever. And please, plan now to come back next year so I can say the same thing about ZooFari 1994.

Sincerely,

Clinton A. Fields
Clinton A. Fields
Executive Director

ZOOGOER

VOLUME 22 • NUMBER 4 • JULY • AUGUST 1993



A Gathering of Cranes.

Japan, late Momoyama/early Edo period, 17th century. Anonymous artist of the Kano school. (The Minneapolis Institute of Arts)

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A team of National Zoo scientists studying these small but fascinating mammals finds, among other things, that less can certainly be more when it comes to raising some kids.

12 **Wild Lands Without Boundaries: A Fresh Start for Conservation in Central and Eastern Europe** *Jeffrey P. Cohn*

The fall of Communism in Central and Eastern Europe and the vast environmental problems caused by pollution throughout this area are familiar stories. What we haven't heard is how the people of the region are working together to preserve wildlife and wild places, brick by ecological brick.

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The Vietnam War devastated habitat and wildlife in the Mekong Delta's Plain of Reeds. But, an ambitious wetland restoration project has brought the return of sarus cranes and other endangered species, and serves as testament to the fact that "if you build it, they will come."

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Wildlife artist Charles Frace to visit the Zoo, new exhibit in the Education Building lobby, Sumatran tiger cubs born, and more.

The MINIMALIST *Otherhood* OF TREE SHREWS

At just a few minutes past dawn, the mother tree shrew furtively approaches the nest chamber. It has been almost 48 hours to the minute since she last visited her two babies and the buildup of milk pressure in her mammary glands tells her it is time to nurse her young. She nervously grooms her belly, leaving dark, wet stains on the fur around her nipples. It is time to go in.

Inside, the babies are ready. They have slept deeply and undisturbed for more than 40 hours, but during the last six hours they have awakened from their deep sleep every 15 to 30 minutes to groom themselves and to remove any traces of urine, droppings, and other material that might leave a telltale odor for a passing predator. Grooming becomes more frequent and intense as the forty-eighth hour approaches—the babies are restless and very hungry.

Even before the mother enters the nest chamber, the babies sense her presence through vibrations caused by her movement on the outside of the nesting cavity. In response, they push themselves up on wobbly forelegs and thrust their heads as high as they can, probing the air with their tiny snouts. As newborns, they will be

sightless and deaf for another two weeks, but they are able to detect their mother's large, warm body with their keen sense of smell. Waving their heads in the air like leeches searching for warm-blooded prey, the babies suddenly pick up her odor.

The mother enters the nest chamber slowly and picks up a leaf—a now-meaningless gesture stimulated by residual hormones that had earlier caused her to construct a huge nest of leaves that completely filled the nesting cavity. Quickly, she approaches the babies in the dark using her sense of smell to guide her. Without as much as a nuzzle or a lick of greeting, she rears up on her hind legs and extends her forelegs to expose her abdomen to the anxious babies.

The babies frantically nose her abdomen, guided by the odor of her saliva on and around her nipples. Within seconds, each makes contact and nurses at one of her four nipples with what can only be described as controlled hysteria. After a few seconds, each baby switches to another nipple, nurses a few seconds, then switches again to another. Slow at first, the switching tempo quickly increases as the mammary glands empty and the babies search elsewhere for milk.

Miles Roberts

After 60 seconds of nursing, in which they consume nearly one-third of their body weight in milk, the babies are bloated but continue to nurse vigorously. Now, the mother becomes restless. Suddenly, with no warning, without as much as a departing look, she simply vanishes. The babies, engorged and seemingly intoxicated with milk, collapse onto one another and laboriously reconfigure themselves into the huddled ball that will best conserve their body heat. Within seconds, they enjoy the sleep of the dead.

On to the Next Litter

After leaving the nest, the mother tree shrew shows little further interest in it. She does not guard it or even visit it except for nursing. She even sleeps in a separate, more rudimentary nest. In fact, except for nursing the young for 90 seconds every other day for the next four weeks—a sum total of about 25 minutes—her investment in the young is virtually complete the moment they are born.

She carried them to term over a gestation lasting about 50 days and spent most of the week before the birth constructing a secure nest. And, when the young emerge from the nest, she nurses the juveniles occasionally for another week while they learn to forage on their

own, but she mostly avoids their advances. At this point, she is pregnant again, having mated the same day this litter was born, and cannot afford to have young still nursing while another litter is developing.

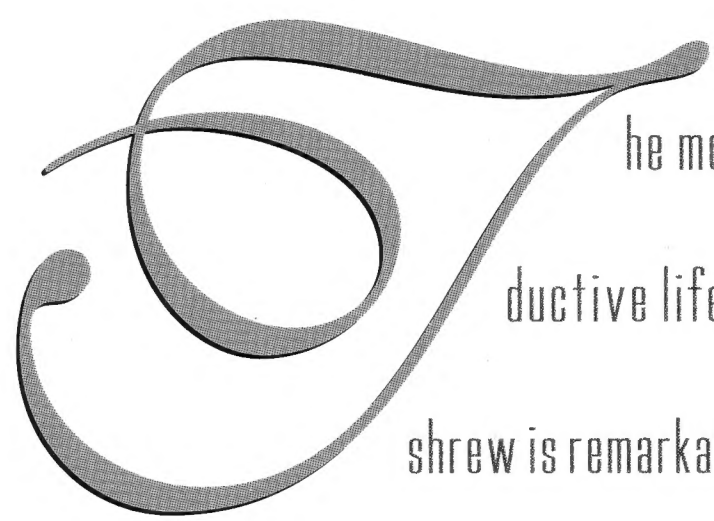
With such minimal maternal investment, one might wonder if the father plays any role in rearing the young. The answer is a resounding no. While evidence suggests that some tree shrews may live in pairs, males appear to play no role in rearing or guarding the young. If the father does provide any help at all—and that's a big if—it is almost certainly limited to indirect forms of care such as patrolling territorial boundaries to keep other tree shrews away from the nest.

The mother will most likely have another two babies in her next litter, but it's possible that she may have as many as four. Born naked, blind, and deaf, and each weighing seven-tenths of an ounce, tree shrew babies are defenseless, easy prey for predators such as civets, martens, cats, and other tree shrews that might happen upon their nest.

But, considering the low frequency and brevity of the nursing visits, the babies grow at an extremely rapid rate, doubling their birth weight within a week and leaving the nest fully ready to take on the world at about 30 days of age. The mother is potentially able to produce a



Climbing down a tree branch, a common shrew (Tupaia glis) searches for food. An adult female tree shrew does not guard or visit her offspring's nest except for nursing. (Jessie Cohen/NZP)



he mother is potentially able to produce a litter every 45 to 50 days. With a reproductive life span of more than five years, the reproductive capacity of the female tree shrew is remarkably high. "Make 'em and move 'em out" would be an appropriate tree shrew motto.

litter every 45 to 50 days. With a reproductive life span of more than five years, the reproductive capacity of the female tree shrew is remarkably high. "Make 'em and move 'em out" would be an appropriate tree shrew motto.

Other Absentee Parents

The tree shrews' reproductive and parental-care system, a defining characteristic of the group, is unusual for mammals, but it is not unique. Minimal postpartum care, in which mothers devote little effort to their young beyond milk, is also typical of most lagomorphs (rabbits and pikas) and some seals (and, to a degree, the elephant-shrews, but that's another story).

Like tree shrews, the rabbits and pikas give birth to multiple altricial young (altricial young are helpless and usually blind, deaf, and hairless at birth), maintain separate sleeping nests, and provide virtually no direct maternal care other than milk transfer. Seals, on the other hand, usually have a single, precocial young (precocial young

are active and able to move freely from birth) and provide some rudimentary maternal care in the form of occasional grooming and huddling. In all of these species, however, mothers nurse infrequently.

Olav Oftedal and Daryl Boness, of the Zoo's Department of Zoological Research, have studied maternal care in a variety of seal species. Their findings suggest that seals nurse their young infrequently because of the time involved in traveling to distant fisheries in search of food. As a result, young seals may go six or more days between feedings. To compensate, seals produce highly concentrated, high-fat, high-energy milk that keeps the infants alive and growing during their mothers' long absences.

Similarly, scientists have found that the milk of rabbits is concentrated and high in fat, but not nearly so much as seal milk. Rabbits, however, nurse their young at about 24-hour intervals. These differences in milk composition and nursing intervals might be accounted for by the types of foods eaten by the mother and the distance



An infant large tree shrew (Tupaia tana) before nursing (left) and after nursing (right). Baby tree shrews consume one-third of their body weight in milk in just 60 seconds of nursing. (Miles Roberts)



A common tree shrew (Tupaia glis) in its naturalistic Zoo habitat. Tree shrews are native to the forests of Southeast Asia. (Jessie Cohen/NZP)

she has to go to get them: Seals primarily eat widely dispersed fish, crustaceans, mollusks, and other high-energy foods, while rabbits are grazers on locally available low-energy grasses.

The close similarities between the reproductive and parental-care strategies of the tree shrews and the lagomorphs have led some scientists to speculate about an ancient evolutionary linkage between these two groups. Their argument states that they were both part of an early evolutionary experiment that used an absentee parental-care system—as opposed to the “shelter-care” system more typically seen in mammals—to reduce predation on nestbound young: infrequent, clandestine maternal nursing visits might attract less attention from predators than repeated visits.

The fact that all species of tree shrews, pikas, and rabbits studied to date have this system suggests that it must be an ancient trait. Hares, however, are lagomorphs closely related to rabbits and pikas but lack an extreme absentee system and give birth to more precocious young. The hare system is believed to have evolved secondarily from one more closely resembling that seen in the rabbits and pikas.

Research at Home and Abroad

The tree shrews’ unusual reproductive and parental-care

patterns prompted me and my colleagues Yadvendra Jhala and Olav Oftedal, with the help of biological technician Frank Kohn and keepers Mike Deal, Cathi Mathias, and Jerry Harris, to study these animals here at the Zoo. We wanted to know how the milk composition of omnivorous tree shrews compares with that of seals and rabbits. We also wondered how mothers and infants balance their energy demands to allow unusually rapid growth and high rates of reproduction despite what appeared to be low levels of parental investment. Beyond that, we also wanted to know what evolutionary and ecological factors selected for such an unusual maternal-care strategy in groups as diverse as rabbits, seals, and tree shrews.

We knew the answer to this last question would require a combination of laboratory and field work, but the kinds of studies we needed of tree shrew reproductive and parental-care behaviors had not been done in the wild. Then, just as we were beginning our project, we discovered that Louise Emmons, a colleague at the National Museum of Natural History, had just started a field study of six species of tree shrews in Sabah, Malaysia. This was just what we needed, because prior to Louise’s field studies, very little was known about tree shrew ecology and behavior.

What we did know suggested that “tree shrew” is something of a misnomer. Most species appear to spend

A Tree Shrew by Any Other Name is...Still a Tree Shrew

The tree shrews are a relatively small, but unusual, assemblage of mammals with a rather controversial scientific history. In 1780, near Saigon, William Ellis, the physician on Captain James Cook's third voyage to the East Indies, was the first Western scientist to encounter a creature that resembled a squirrel but ate fruit, insects, and small animals. Ellis surmised from the appearance of its teeth that the creature wasn't a rodent and guessed that it might somehow be related to the insectivorous moles and shrews. Because of its seemingly arboreal habits and eclectic diet, he dubbed it "tree-shrew," a moniker that has persisted until today.

In the 90 or so years that followed, naturalists from India to the Philippines added specimens of more than a dozen other tree shrew species to museum collections, where curators dutifully cataloged them as insectivores. Among these scientists was Sir Stamford Raffles, the renowned British naturalist in Malaysia, who named one of the genera *Tupaia* after the Malay word for squirrel, *tupai*. But, in 1872, Sir Thomas Henry Huxley made the radical observation that some characteristics of tree shrews, most notably their relatively large brains and the ring of bone surrounding the eye socket, were remarkably similar to those of primates.

In the early 1900s, scientific notables W.K. Gregory and

W. Le Gros Clark sustained Huxley's somewhat contrarian opinion, citing their own "convincing" anatomical evidence of the tree shrews' primate affinities. Ultimately, the father of modern American paleontology, George Gaylord Simpson, virtually codified this school of thought in 1945 by classifying tree shrews as prosimians, the so-called lesser primates.

For years, tree shrews held the exalted rank of primate. Students and journeyman scientists alike were indoctrinated with the notion that tree shrews reflected the earliest primate condition, and primatologists everywhere clamored to know more about them in the hope of discovering the essence of our primate origins. But deeper study led to doubts and finally to rejection of a primate provenance, as biochemical, behavioral, physiological, and reproductive evidence each revealed that tree shrews are in fact something less than primates.

However, these studies also revealed that tree shrews are something more than insectivores. Today, the five genera and 18 species of tree shrews, all inhabitants of Asia, are considered to be a distinct enough radiation to be placed in an order of their own, the Scandentia. Primate stepchildren no longer, once-humble tree shrews now enjoy a taxonomic position equivalent in rank to the order Primates and Insectivora.

—Miles Roberts

much of their time foraging on the ground, and some even nest in subterranean burrows. All tree shrews are capable climbers, however, and will retreat to the trees (where they are more likely to be seen) when disturbed. When

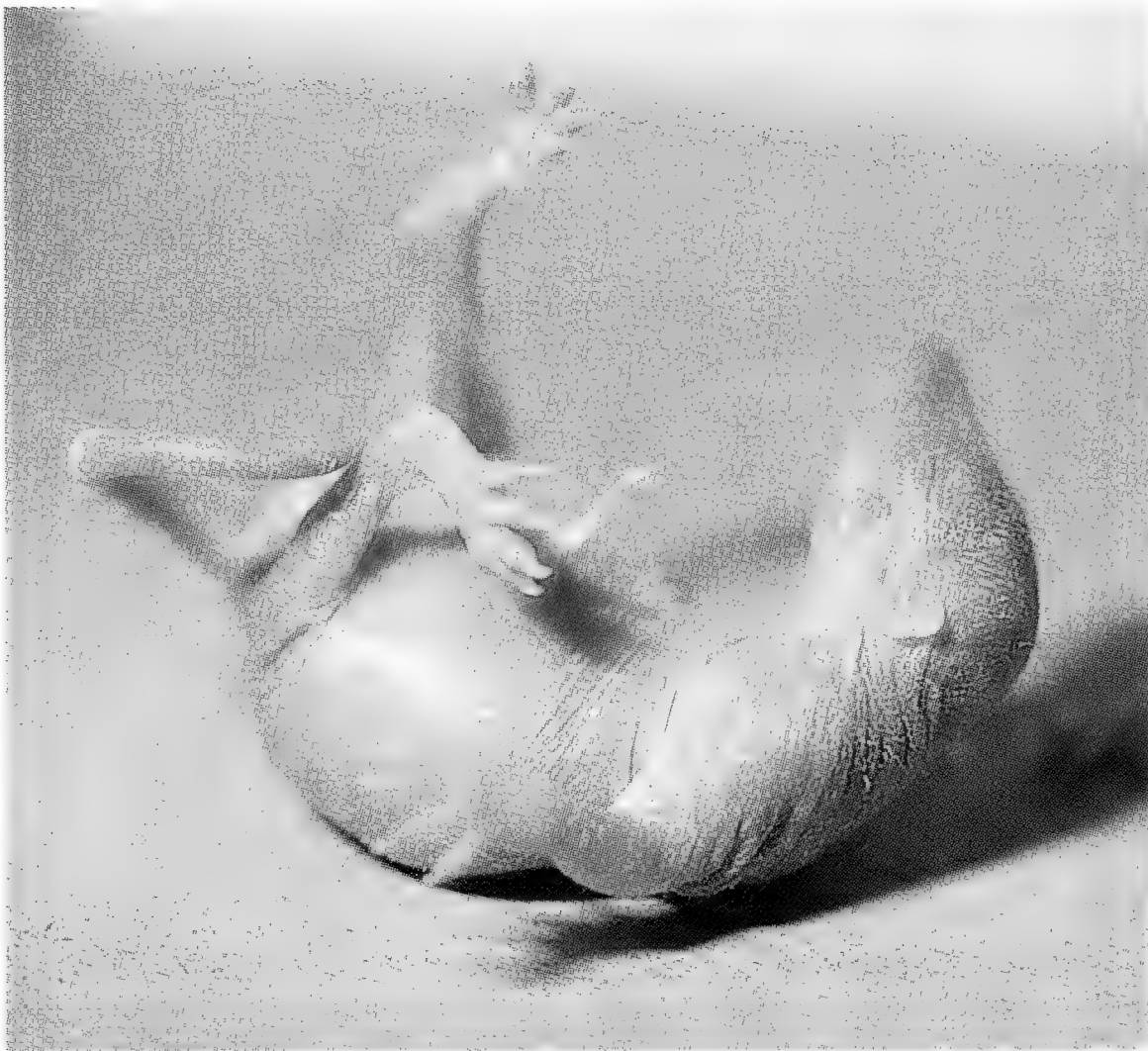


A lesser tree shrew (*Tupaia minor*) sits up on a branch. (Jessie Cohen/NZP)

several species live in the same geographic area, as is the case in some parts of Borneo, they are likely to be of different sizes and to use different parts of the habitat at different times of the day as a means of reducing interspecific competition. However, the details of tree shrew community ecology remain unknown—elucidating them is one of the goals of Louise's study.

The social organization of tree shrews has also been something of a mystery. A study of *Tupaia glis* in a Singapore forest indicates that the nonoverlapping home ranges of males encompass those of one or more females, suggesting that this species, and possibly others, may live in pairs or harems. Surprisingly, animals living in so-called pairs rarely encounter or interact with one another and, if they were not living in tightly overlapping home ranges, might even be considered solitary.

Whatever the social arrangement, it is clear that members of each sex attempt to keep other same-sex individuals out of their home ranges, or territories. Males are especially vigilant in their territorial duties. A male chest



Newborn tree shrews are naked, blind, and deaf, and weigh seven-tenths of an ounce. (Frank Kohn)

gland exudes a fatty secretion that, when mixed with urine, produces a particularly pungent and long-lasting odor that is used to mark territorial boundaries. As mentioned previously, males appear to contribute no direct parental care, but their territorial behavior may help to exclude other tree shrews that might harm babies or take resources that could otherwise be used by the lactating mother. In this sense, “pair-living” male tree shrews may possibly provide what is known as indirect parental care. We hope Louise’s research will shed some light on this aspect of tree shrew biology, too.

Lives on the Edge

Our research is not yet complete, but we have some intriguing insight into tree shrew biology. For example, we did discover that tree shrews have concentrated milk that, as expected, is somewhat higher in fat and energy than that of the grazing rabbits and pikas, but less than that of the carnivorous seals.

But, possibly the most important thing we have learned is that babies getting milk only every other day live truly close to the edge. By equipping tree shrew nest-boxes with infrared video cameras, we were able to record exactly how long each infant nursed during each nest visit and to correlate this with its growth rate. We found that if an infant misses as little as 30 seconds of nursing time just *once* in the first two weeks of life, it is enough to significantly slow its growth rate relative to its sibling!

What’s even more surprising is that the reduced growth rate persists over time and translates into significantly lower weights at weaning and sexual maturity for infants that miss nursing time. The ramifications of this for an individual’s life are simply enormous: Body size can poten-



In just three and a half weeks, young tree shrews are prepared to leave their nest-box. (Miles Roberts)

tially affect an individual’s ability to successfully compete for territories and food and to rear young. Missing only part of one nursing, one time, can have a multiplier effect with lifelong consequences.

Our studies of the tree shrew’s interesting life history strategy will continue for another year or so as we try to answer the many new questions our research has raised. For instance, we still don’t know how baby tree shrews store and use the milk they ingest without its curdling in their stomachs and causing severe gastric distress.

On the behavioral side, we suspect that nestbound siblings may subtly compete with one another for nursing advantage, as an early head start appears to have long-lasting advantages. But, what’s in one baby’s self-interest may not be in the mother’s interest at all, as she would undoubtedly prefer to wean two (or more) competitive offspring rather than one “supercompetitor.” Or would she? Does she attempt to control how much each of her babies gets, and if so, how does she do it? To answer these questions, and the many more that flow from them, we have begun to investigate in detail whether siblings and mothers are involved in some sort of subtle, selfish gamesmanship.

In the meantime, while we’re busy contemplating tree shrew politics and social life, stop by the Small Mammal House to see the tree shrews on exhibit. At first glance, these creatures seem simple and nothing out of the ordinary. But they do have fascinating stories to tell. You can even tell a story of your own if you happen to be in the company of a child who is less than enthusiastic about drinking milk. ♣

Miles Roberts is Deputy Head of the Zoo’s Department of Zoological Research.

Wild Lands Without

BOUNDARIES

A Fresh Start For Conservation in Central and Eastern Europe

If ever a picture spoke volumes, Mircea Staras's did. The photo showed a section of the Danube Delta's extensive reed beds going up in smoke. With those burning reeds, so too goes habitat for a vast array of birds and other wildlife living among the delta's innumerable channels, marshes, and lakes where Europe's second longest river empties into the Black Sea.

The Danube Delta's human inhabitants burn the reeds, Staras explains, to clear land to plant crops and graze cattle. Likewise, economic development programs sponsored by the Romanian government have yielded dredged and diked channels and waters polluted with industrial wastes and agricultural chemicals. Together, these and other human activities threaten Europe's largest and most important wetland.

"Burning the reeds and clearing the land is transforming the delta," says

Staras, scientific director at Romania's Danube Delta Research Institute in Tulcea, a city on the Danube. "If we can stop [the burning], we can help the delta recover. We must find a balance between conservation and economic growth."

The struggle to preserve the Danube Delta is illustrative of the problems and opportunities facing those like Staras who seek to conserve and restore the few remaining natural areas in the former Communist countries of Central and Eastern Europe.

Despite almost overwhelming political, economic, and environmental problems, Romania and the other former Communist countries are working to expand and give additional protection to places like the Danube Delta, and to convert them into wildlife refuges that transcend national borders.

For the past several years, the world has watched with surprise and awe as

the countries of Central and Eastern Europe have overthrown their Communist regimes and initiated reforms aimed at giving them more open societies, democratic political processes, and free-market economies.

But the Western news media's focus on economic, political, and constitutional developments, however understandable, has too often been at the expense of equally important environmental issues in Central and Eastern Europe. And, even when attention has been given to the environment, the spotlight has usually been on so-called brown issues, such as air and water pollution, rather than the "green" problems of habitat and wildlife conservation.

With or without publicity, however, protecting Central and Eastern Europe's wild areas will not be easy. Political and ethnic unrest in the former Soviet republics, civil war in the former Yugoslavia, and the breakup of

Jeffrey P. Cohn

Czechoslovakia are making environmental advances in those countries difficult at best. In some cases, these crises may even pose direct threats to wildlife.

Further, economic turmoil throughout Central and Eastern Europe tends to force environmental issues into the background. "We need to see environmental issues as separate from economic development," says Yuri Ruban, the Ukraine's first deputy minister for environmental protection.

The Wild that Remains

Together, these developments underscore the need to seize opportunities that exist to protect remaining wild areas in the former Communist countries, says Richard Liroff, director of the World Wildlife Fund/U.S.'s Central and Eastern European programs.

For starters, environmental ministers from 21 former Communist countries issued a joint statement in February 1993, at the White Oak Conservation Center near Jacksonville, Florida. The ministers agreed

to consult with one another, exchange information, and seek regional solutions to cross-boundary environmental problems. "Our drastic ecological situation requires global solutions," says Alexei Yablokov, Russian state counselor for ecology and public health.

One drastic solution is taking place in Slovakia. There, the World Wide Fund for Nature (formerly World Wildlife Fund/Europe) has organized students and volunteers to guard nests of the endangered saker falcon from thieves who steal chicks and eggs. WWF now supports a public awareness campaign in Slovakia that focuses on birds of prey.

More important, a strong hunting tradition led several Central and Eastern European countries to create national parks or other protected areas long before their Communist regimes were toppled. The former Soviet Union, for example, had 188 nature conservation areas, or *zapovedniki*, totaling more than 60 million acres in 1989. Of that total, the Russian Re-

public's *zapovedniki* alone covered 50 million acres.

Similarly, when Communism fell in 1989, Poland already had 17 national parks totaling 415,000 acres, and 68 landscape areas with three million acres. Landscape areas are widely used in Central and Eastern Europe to designate land less strictly protected than a national park.

Further, some areas in Central and Eastern Europe remained undeveloped under Communism and thus still retain much of their wild nature. Many of the latter—as well as many national parks and landscape areas—are located along borders, especially those between former Communist and Western countries. They often served as no man's lands that prevented people from easily crossing from one country to another during the Cold War.

"Ecological Bricks"

The potential importance of these areas was recognized at a 1990 meeting in Prague sponsored by some three dozen



Peat bogs in the Czech Republic's Sumava National Park. (WWF—Richard Liroff)



Development in the Danube Delta threatens Europe's largest and most important wetland. (Grant Cadwallader, National Park Service)

European conservation groups. Led by World Wide Fund for Nature/Austria, the groups identified 24 national parks and other natural areas in Central and Eastern Europe that could serve as "ecological bricks" for building a series of multinational nature reserves.

"Time presses if we are to preserve the last natural habitats and with them our environmental heritage," wrote Alexander Zinke for WWF/Austria in the journal *Politische Ökologie*. "The great political changes in East and Central Europe offer us the definite opportunity to create a new ecological backbone for Europe."

One ecological brick is Bieszczady National Park. Located in the eastern Carpathian Mountains where the Polish, Slovakian, and Ukrainian borders meet, Bieszczady features lushly treed mountains, low hills, and damp valleys. Here, the east-west lying Carpathians form a continental divide between north- and south-flowing rivers. The area was intensively grazed for centuries, but

now has few people, a recovering plant community, and a growing wolf population.

For its part, Poland established Bieszczady National Park in 1973 and tripled its size to more than 42,000 acres in 1989. In Czechoslovakia, the adjoining Vychodne Karpaty landscape area was created in 1977 and expanded in 1989 to protect 167,000 acres. A nature reserve in the Ukraine protects another 5,000 acres, which Ukrainian officials plan to expand to 12,500 acres.

To the north of Bieszczady lies Bialowieza National Park, about 150 miles east of Warsaw on the former Polish-Soviet border. Created in 1921, Bialowieza's virgin fir, spruce, and beech stands, moss-covered oaks, and wet bogs comprise one of Europe's last primeval forests outside Scandinavia. The park totals 145,000 acres in Poland, plus another 220,000 acres in the newly independent Belarus.

Bialowieza was the site of the first reintroduction to the wild of captive-bred Eu-

ropean bison in 1959. The bison had been extinct in the wild since the end of World War I. Some 250 European bison, a slightly smaller species than its American cousin, now roam Bialowieza. Another 200 are at Bieszczady, while others have been released in the Caucasus and elsewhere in Russia.

A third ecological brick lies along the joint German, Austrian, and Czech borders. With nearly 200,000 acres of mixed spruce, fir, and beech trees, the area contains few people or roads. It has long served as a refuge for European lynx, otters, the rare black grouse, and the capercaillie, another member of the grouse family.

West Germany created Bayerische Wald National Park to protect its Bavarian forest in 1970. The reserve now encompasses some 32,000 acres. At about the same time, Czechoslovakia established a landscape area on its side of the border, in Bohemia. That landscape area was given further protection in 1991 when Czechoslovakia declared it Sumava National Park.

The Danube Delta is a 1.4-million-acre expanse of mixed forests, grasslands, sand dunes, and reed-dotted river channels, lakes, and marshes. Lying at the junction of several bird migration routes, the delta has long been one of Europe's most important wildlife refuges.

Nearly 200 bird species breed in the delta, including 60 percent of the world's pygmy cormorants, half the white pelicans, and the rare white-tailed eagle. Others, such as the threatened slender-billed curlew, migrate through the delta in fall and spring. During the winter, the delta hosts more than one million ducks, geese, and other waterfowl.

International Parks, International Cooperation

Fortunately for the Danube Delta and the other ecological bricks, most of Central and Eastern Europe's new governments have

Despite almost overwhelming political, economic, and environmental problems, Romania and the other former Communist countries are working to expand and give additional protection to places like the Danube Delta, and to convert them into wildlife refuges that transcend national borders.

recognized the need to protect their natural habitats, says WWF's Liroff. Romania, for example, created 13 new national parks in the last two years, and Bulgaria two—Central Balkans and Rila—in 1991.

Because many are located along borders, the ecological bricks illustrate the international nature of efforts to protect wildlife and natural habitats in Central and Eastern Europe. Bialowieza and Bieszczady alone involve four different governments—Poland, Belarus, the Ukraine, and Slovakia—the latter three newly independent countries.

"It is surprising how much cooperation between governments is taking place," says Stanley Kabala, director of international programs at the University of Pittsburgh's Center for Hazardous Materials Research.

In another sense, however, the ecological bricks illustrate the problems that remain to be resolved in Central and Eastern Europe. For one thing, many national parks, Liroff says, are protected areas in little more than name. Most countries in the region lack money to hire enough staff to adequately protect their parks or to develop plans for managing them.

Many observers also worry that in their rush to achieve privatization and economic stability, many Central and Eastern Euro-

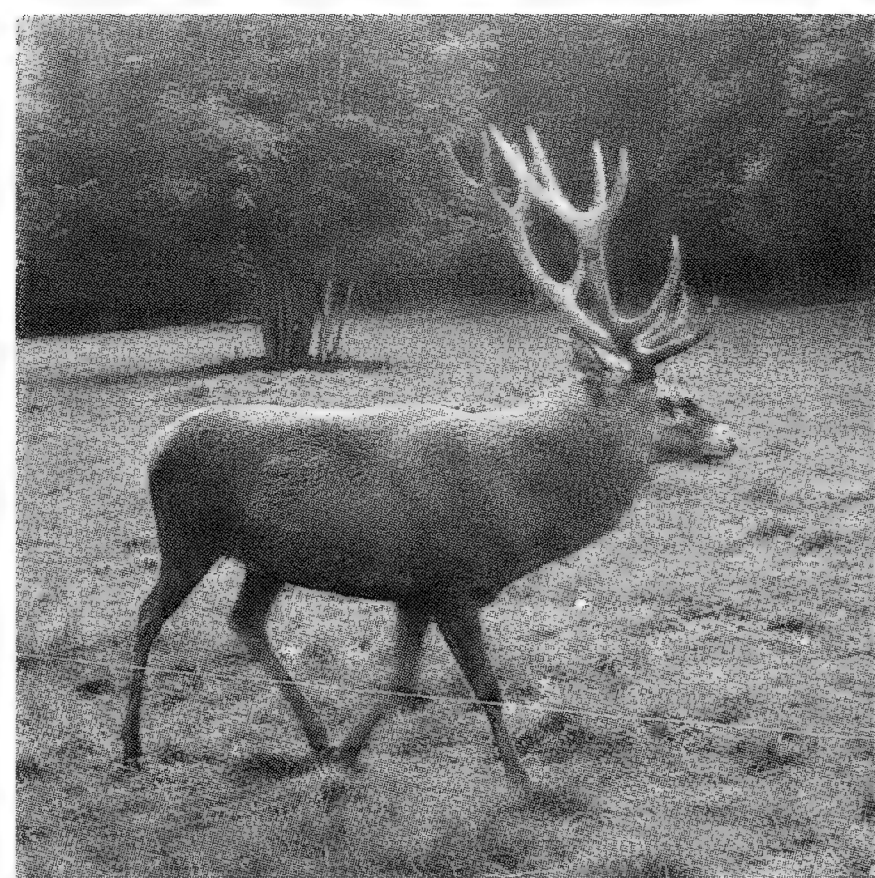
pean countries will encourage development that could encroach on natural areas. In the Czech Republic, for example, intensive logging, road construction, and increased tourism threaten Sumava National Park.

"The mere substitution of a free-market economy for Communism does not automatically guarantee that conservation concerns will be better served," says Michael Wolfe, a wildlife biology professor at Utah State University in Logan.

"We have to help them see the economic value to be derived by protecting biodiversity and by developing ecotourism," adds Liroff, pointing to international efforts to encourage governments to invest in habitat conservation. He cites Bialowieza's bison and Sumava's Bohemian forests as potential tourist attractions.

The Daunting Obstacles

A related problem is a lack of equipment. "There are some excellent researchers" in Central and Eastern Europe, says Lawrence Mason, chief of the U.S. Fish & Wildlife Service's international affairs office. "But they are limited by their lack of tools. They are hungry for equipment." Mason gives as an example the case of wildlife biologists studying predator-prey relationships in



Red deer in Bialowieza National Park, Poland. (WWF—Richard Liroff)

Bialowieza National Park who lack radio collars to track the animals.

Similarly, at Pirin National Park in Bulgaria, a United Nations-proclaimed World Heritage Site, guards have 50 radios for communicating with one another. But none work, states Sharon Cleary, the U.S. National Park Service's coordinator for Central and Eastern European programs. There is no money, Cleary adds, for new uniforms let alone for functioning radios. On the other hand, Kabala says, the Polish, Czech, and Slovak parks, in particular, are



Touring Bialowieza National Park, Poland, by horse-drawn carriage. (WWF—Richard Liroff)

Europe's "Ecological Bricks"

1. Finnish-Russian woodland area
2. Biebrza Marshes
3. Bialowieza virgin forest
4. Schorfheide/Chorin area
5. Spreewald
6. Sächsishe Schweiz
7. Karkonosze area
8. Tatra area
9. Pieniny area
10. Bieszczady region
11. Slovakian Karst
12. Floodplain areas of the Danube, Thaya, and March
13. Thaya valley
14. Trebonsko Pond region
15. Bavarian Forest, Bohemian Forest area
16. Lake of Neusiedel
17. Mur floodplain
18. International Karst Park
19. Lower reaches of the Drau and Kopacki-Rit
20. Sava floodplain
21. Danube Delta
22. Lake Scutari
23. Prespa area
24. Rhodope Mountains, Nestos Delta, and adjoining areas

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well run, have experienced administrators, and numerous visitor services.

Another problem involves the actual amount of protected land in Central and Eastern Europe's ecological bricks. In many, the protected land area is far smaller than the natural area itself. In the Danube Delta, for instance, only about 125,000 acres—less than 10 percent of the total area—is set aside as a national park. Likewise, only about one-third of Bialowieza is fully protected.

A more serious problem, however, is the pollution that has so far been the focus of the news media's coverage of Central and Eastern European environmental issues. The same industrial wastes, untreated sewage, and air pollution that threaten human health affect animals, plants, and natural habitats throughout the region.

"We cannot solve wildlife problems by protection alone," says Stephen Deets, di-

rector of the National Academy of Sciences' Central European policy program. "To solve wildlife problems we have to solve environmental problems. The status of wildlife depends on the status of the environment."

Take the case of the Sudety, a mountainous and largely undeveloped region where German, Polish, and Czech borders meet. Karkonosze, Sächsische Schweiz, and Trebonsko Pond, all landscape areas within the Sudety, have been earmarked by European conservationists for wildlife protection as ecological bricks.

But trees and other plants have been dying throughout the Sudety for more than a decade. The cause: polluting emissions from more than a dozen coal-burning electrical power plants in the infamous "black triangle" of southeastern Germany, southwestern Poland, and the northern Czech Republic, says Andrew Bond, a biodiversity consultant to the World Bank.

International Assistance

To better understand the biological effects of air pollutants in Central and Eastern Europe, and to protect the area's natural heritage, the World Bank and the United Nations Environmental Program (UNEP) have launched a \$6.2 million biodiversity project in the Sudety and Bialowieza. The project is being funded through the Global Environmental Facility, a \$1.4 billion trust fund set up by the World Bank and UNEP to foster worldwide environmental protection.

The biodiversity project will enable Polish researchers to create a gene bank for endangered plants, map the biological resources of the two regions, undertake wildlife conservation studies, and help local farmers adopt more ecologically sound agricultural practices, says August Schumacher, a World Bank senior agricultural economist and project manager.

Additionally, the United States and Western European countries have agreed to forgive half of Poland's \$33.3 billion foreign debt in a "debt for nature" swap. Poland plans to use the money to support biodiversity, reduce greenhouse gas emissions, and initiate international water and air pollution cleanup projects, Liroff says. One project already begun involves restoring degraded wetlands in Biebrza Marshes, an ecological brick site in northeastern Poland.

Likewise, the U.S. Agency for International Development is supporting research on environmental pollution and other problems in the Danube Delta. The aim is to gauge the effects of intensive agricultural, forestry, and fish farming projects begun in the delta in the 1970s by Romania's former Communist government.

As a result of those projects, says Brian Howes, an associate research scientist at the Woods Hole Oceanographic Institute in Massachusetts, the delta's channels were heavily diked and polluted and the marshes

In another sense, however, the ecological bricks illustrate the problems that remain to be resolved in Central and Eastern Europe. For one thing, many national parks, Liroff says, are protected areas in little more than name. Most countries in the region lack money to hire enough staff to adequately protect their parks or to develop plans for managing them.

widely drained. “[Romania’s former Communist leader Nicolae] Ceaucescu wanted economic value from every square inch of the country,” Howes says. “A huge chunk of land was removed from the delta as effectively as if it were moved to Kansas.”

Even today, four years after Ceaucescu’s overthrow, the fight to save the Danube Delta’s wilderness continues. Romania banned land reclamation and sand mining schemes in the delta in 1989, and declared a large part of the area an international biosphere reserve in 1990. Still, pesticide and fertilizer use continue to upset the delta’s fragile ecological balance, according to the Danube Delta Research Institute’s Staras.

On the other hand, Staras cites 75,000 acres of abandoned farmland in the delta that could be returned to a natural state. The land’s marshes were drained, leaving a dry, heavily salt-laden soil. Still, Staras says, “If we are to save the delta we must restore those wetlands.”

“Hell-bent for Industrialization”

“The Communists were hell-bent for industrialization,” the University of Pittsburgh’s Kabala says of Romania and the other former Communist countries.

One example of this philosophy that has survived the downfall of Communism lies in southeastern Slovakia and northern Hungary. There, at Gabčíkovo, a newly completed dam diverts the Danube’s waters from their natural channels into concrete canals that lead to hydroelectric dams and artificial reservoirs.

Critics of the Gabčíkovo-Nagymaros project, which was launched in 1977, charge it will reduce river flow, lower water tables underlying some of Europe’s most productive farmlands, dry up wetlands, and threaten healthy populations of red deer, beavers, and European river otters.

So far, despite protests from local and international environmentalists, Slovakia has continued to support the Gabčíkovo



Ranger in Bieszczady National Park. (John Reynolds, National Park Service)

project. Hungary, on the other hand, dropped the project in 1991.

Another problem for wildlife is Central and Eastern Europe’s waterways. Nearly two-thirds of Poland’s surface drinking water is so clogged with industrial wastes and untreated sewage it is considered unfit for human consumption, says Hilary French, a senior researcher at the Worldwatch Institute.

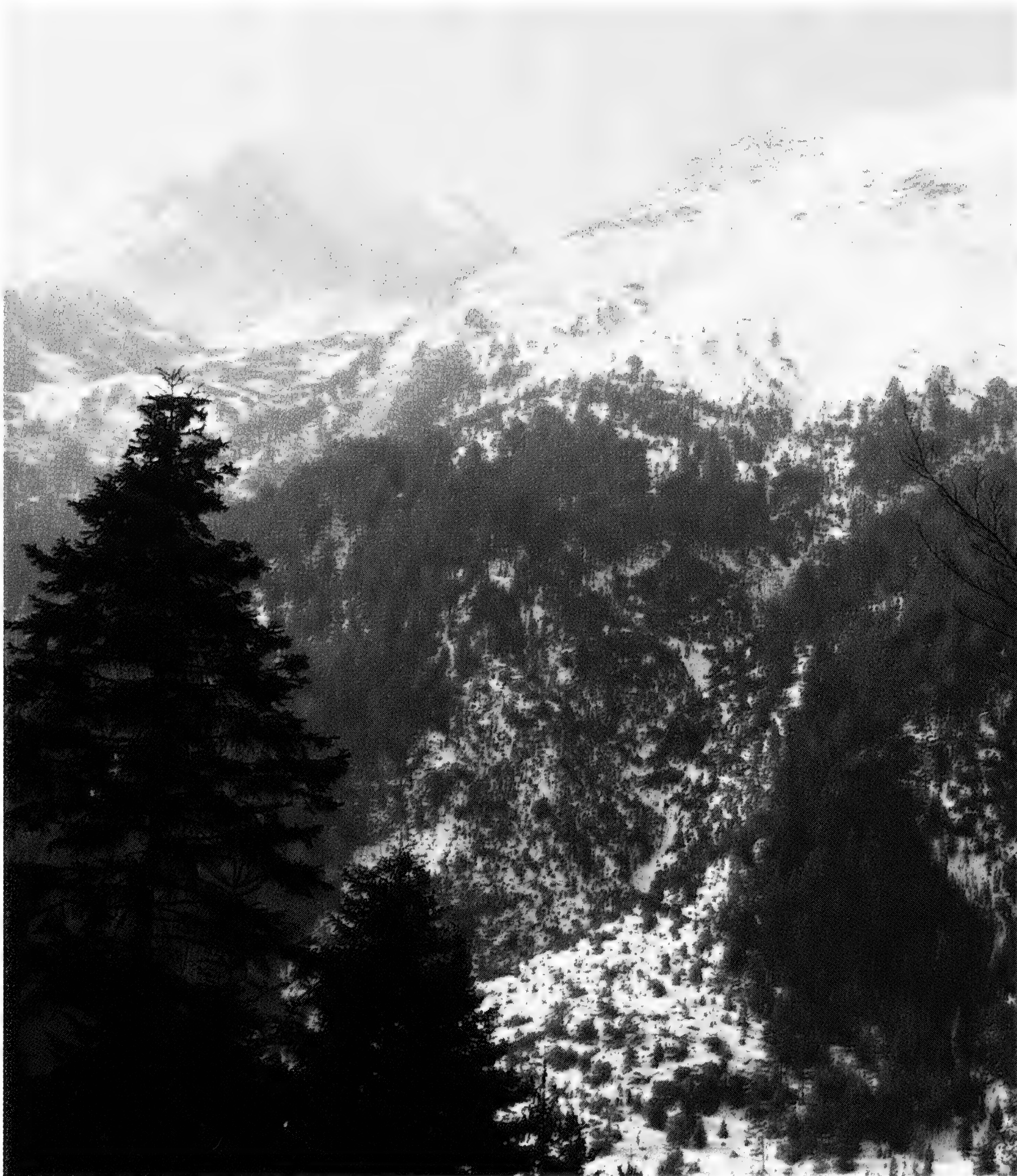
Similarly, 70 percent of Czech rivers are badly polluted and half of those in Slovakia no longer support aquatic life, French states. And 75 percent of Russia’s surface waters fail to meet safe drinking standards, Russia’s Yablokov adds.

Despite these difficulties, most American observers seem at least somewhat optimistic about the ecological outlook for Central and Eastern Europe. “There is a sound recognition by many people in different countries of the importance of wildlife conservation and habitat protection,” says the World Bank’s Bond. “You have to remember their whole political and economic structure has changed. They are doing a terrific job given their problems.”

WWF’s Liroff agrees, but mixes words of caution with his hopes for Central and Eastern Europe. “I blow hot and cold,” he says. “It is really hard to predict what will happen. I hope they show great wisdom and see how disrupted ecosystems can become, and don’t let that happen.”

“There is a window of opportunity in Central and Eastern Europe to protect wild areas and to avoid losing them,” Liroff adds. “The window may be wider, at least for some places, than many of us originally thought. But we have to act now.” ❖

Jeffrey P. Cohn is a freelance writer specializing in conservation subjects.



Winter scene in Pirin National Park, Bulgaria. (Sharon J. Cleary, National Park Service)

A HAVEN

Among the Reeds

The Plain of Reeds, a wetland that stretches from the southern tip of Vietnam into Cambodia, used to be a haven for the endangered eastern sarus crane (*Grus antigone sharpii*). But the stately red-headed, red-legged cranes abandoned the Plain of Reeds in the early 1960s when the Vietnam War turned the wetland into a wasteland. Now, with American help, the Vietnamese are restoring a part of the plain called Tram Chim and the five-and-a-half-foot-tall cranes have returned. The thousand or so eastern sarus cranes that winter in Tram Chim constitute essentially the last flock in Southeast Asia.

Before the war, the Plain of Reeds flooded annually when summer monsoon rains filled the Mekong River beyond the capacity of its banks. The overflow spread across the plain, a

lowland in the Mekong Delta, in a great sheet toward the South China Sea, cleansing it of decaying organic matter and depositing the nutrient-rich silt that supported the wetland's abundant wildlife. Merely damp during the winter dry season, the Plain of Reeds was submerged under up to 10 feet of water during the peak of the May-to-November rainy season.

This life-giving water cycle of inundation and recession was disrupted during the war. North Vietnamese troops entered South Vietnam via the Ho Chi Minh Trail, which led south through Cambodia to the Plain of Reeds. Once in the plain, the North Vietnamese were protected by the dense vegetation.

Right: Eastern sarus crane at Tram Chim.
(George Archibald/ICF)

Robin Meadows



"We think it was then a savanna of tall wetland grasses, generally as high as one to two meters [up to six-and-a-half feet], and rear mangroves, which are not a true mangrove—they are strictly freshwater," says Richard Beilfuss, a wetland ecologist at the Wisconsin-based International Crane Foundation (ICF). Beilfuss is helping to restore Tram Chim, which translates roughly to "bird swamp."

To destroy the North Vietnamese's refuge, French and U.S. forces dug ditches in the late 1950s and early 1960s that diverted the Mekong River floodwaters from the plain. As the wetland drained, the troops burned the grasses and mangroves, killing or driving out the many species that lived with them. Besides birds, "there were several interesting species of animals that are probably very rare now in the Mekong Delta. These include a fishing cat, two otterlike animals, and a python-sized snake."

While the fires were devastating, the water diversion was fatal to the Plain of Reeds. The plain still flooded during the rainy season, but the ditches drained the area much more quickly than normal, creating a prolonged dry season. Before the ditches were dug, the water table dropped

only slightly below the soil surface during the dry season, and even then an overlying mat of dead grasses kept the soil waterlogged. But after the ditches were dug, the water table dropped as much as four feet below the surface, exposing the sulfate soil underlying the dense grass to air.

The exposed soil reacted with oxygen to form sulfuric acid, which contaminated the wetland at the onset of each rainy season. "The reaction [also] releases toxic concentrations of aluminum and iron, which are biologically devastating," says Beilfuss. "The water is extremely toxic when the rainy season begins."

The deadly water kills many of the microorganisms and aquatic animals at the bottom of the wetland's food web, leaving the plain nearly devoid of life. However, "some organisms survive, including strains of algae and [plants adapted to] acid-sulfate soil," according to Beilfuss. "And the area is repopulated as floodwaters move in each year and flush out the toxic water. By the end of June the water is back to normal."

A Homecoming of Cranes

The Plain of Reeds was further damaged after the war, when thousands of displaced

people settled there to grow rice. But domestic rice grew poorly in the plain's acid environment, prompting then provincial leaders Nguyen Xuan Truong (who is known by his nickname "Muoi Nhe") and Le Van Thoi to reestablish economically useful natural resources in the part of the plain now called Tram Chim. These resources included the rear mangrove trees, which yield fuel, honey, and medicine; marsh sedge, which provides fodder for water buffalo; and crabs, turtles, and other sources of high-quality protein.

"Muoi Nhe grew up in this area and subsisted on the wetland's resources during the war. He wanted to restore the rear mangrove forests and grasslands, and this area was ideal because, even though it had been degraded during the war, there were still intact pieces," says Beilfuss. Muoi Nhe chose a nearly 12,000-acre area and built 10-foot-high dikes around it to capture the monsoon rains and retain moisture during the dry season.

By 1984, the dikes surrounding Tram Chim were complete and the Vietnamese planted rear mangrove seedlings. "The grasses came in naturally," says Beilfuss. "The dikes brought back water and the grasses germinated." In 1990, the Vietnamese added

NEW AND REDISCOVERED SPECIES IN VIETNAM

Two living treasures were recently found in the forests of Vietnam. As reported in the June 3, 1993, issue of *Nature*, researchers from the Vietnamese Ministry of Forestry and the World Wide Fund for Nature discovered a new species of hoofed mammal in the Vu Quang Nature Reserve near the Laos-Vietnam border. The new bovid, *Pseudoryx nghetinhensis*,



Tonkin snub-nosed langur. (Stephen Nash/Conservation International)

weighs more than 200 pounds and has several unique characteristics—long, smooth, and slender horns, elongated premolars, dark-brown to reddish-brown body color, black and white facial markings, and small hooves. Scientists note that *Pseudoryx* is different in appearance, morphology, and DNA sequence from any other known genus of bovid, a group that includes cattle, antelopes, and goats. Unfortunately, no scientist has seen a living *Pseudoryx*. The identification is based on three sets of horns found in hunters' houses and 20 specimens that villagers trapped.

The Tonkin snub-nosed langur (*Rhinopithecus avunculus*), a monkey scientists thought was extinct due to logging, farming, hunting, and war, was recently rediscovered in its forest habitat. After a Tonkin was spotted in a northern Vietnamese village, Noel Rowe, president of Primate Conservation, Inc. (PCI), and his colleagues from Vietnam's Institute of Ecology and Biological Resources, embarked on a search for this most endangered of all Asian primates. They found 25 Tonkin snub-nosed langurs in the highland forests near Na Hang, 150 miles north of Hanoi. PCI and Vietnamese authorities have already started programs to protect the Tonkin and its habitat.

—Regina Hoang



The cranes that winter at Tram Chim constitute essentially the last flock in Southeast Asia. (George Archibald/ICF)

nearly 3,000 dike-enclosed acres to Tram Chim for a total of 14,826 acres.

Although initially intended solely as a means of boosting the local economy, Tram Chim is also now a nature reserve. The turning point came when the eastern sarus cranes returned in 1986 after an absence of more than 20 years. Their homecoming was cause for celebration. “In Vietnam there is a strong reverence for the cranes, just as in China and many other Asian countries. The crane’s local name means ‘holy bird,’ and they have a lot of cultural and religious significance. They are seen as the bird that carries your soul to heaven when you die,” says Beilfuss.

“When the cranes returned there was a huge international outcry to protect them. The Vietnamese expanded their view of Tram Chim from a means of economic gain to a nature reserve. They restored the area for the resources, but as the birds returned, they protected them from hunting.”

Beilfuss speculates that although the war dispersed the cranes, probably to Laos or Cambodia, they returned to Tram Chim because they remembered the area. “Cranes live a long time—up to 40 years

in the wild—and they likely used to nest in Tram Chim,” he says.

Giving the war-scattered cranes a place to flock may be essential to their survival. “Cranes are very social birds,” says Beilfuss. “Grouping during the dry season is a big part of their mate selection.” While they have not yet begun to mate in Tram Chim, without the reserve they probably would have died out in Vietnam.

Transforming Tram Chim

After the cranes returned to Tram Chim, scientists and conservationists from Vietnam and from the International Crane Foundation began developing a plan to restore and manage the reserve. Beilfuss and ICF field ecologist Jeb Barzen worked intensively on the plan. “We wanted to help [restore Tram Chim] because it’s one of the last and most important wetlands in Viet-

Although initially intended solely as a means of boosting the local economy, Tram Chim is also now a nature reserve. The turning point came when the eastern sarus cranes returned in 1986 after an absence of more than 20 years. Their homecoming was cause for celebration.

CALLING ALL CRANES

The male sarus crane at the National Zoo stretched to his full height, raised his bill to the sky, and let loose a trumpet blast of sound. A squeal of nervous delight erupted from the young children gathered in front of the exhibit. The crane trumpeted again. The kids squealed. Trumpet. Squeal. Trumpet. Squeal. Finally, the kids moved on, but still talked excitedly about the crane and glanced back for a final admiring look.

Cranes have intrigued humans for much of recorded history, and for reasons that still attract faithful crane-lovers.

"Cranes are charismatic birds," says David Thompson, education director at the International Crane Foundation in Baraboo, Wisconsin. "They are one of the tallest birds, they go on long migrations, and they have wonderful voices. They're electrifying when you hear them."

Cranes are big and beautiful. Many of the 15 different species worldwide stand as tall as a person. The tallest species is the sarus crane (*Grus antigone*) of Southeast Asia. Males can reach almost six feet in height, and weigh up to 18 pounds. The red-crowned crane (*Grus japonensis*) of northeast Asia, while slightly shorter than the sarus, is heavier, with males reaching 25 pounds. The demoiselle crane (*Anthropoides virgo*) of Eurasia is the smallest species, standing only about three



Sarus crane (*Grus antigone*) lets loose a trumpet blast of sound. (Jessie Cohen/NZP)



Wattled crane (*Buggeranus carunculatus*). (Jessie Cohen/NZP)

feet tall. But it has an elegant black neck and white feathery ear tufts that drape several inches down its nape. All the cranes have long slender necks and long sticklike legs.

Of the 15 species, two live in North America, six in Asia, four in Africa, two in Eurasia, and one in Australia. All belong to the taxonomic family Gruidae. This is one of the most ancient groups of birds still flying on earth—scientists believe that the earliest cranes first appeared some 60 million years ago.

Cranes around the world are remarkably similar in their ecology and behavior. They tend to live in or near wetland areas, mostly feeding on vegetation but also eating insects and small amphibians and reptiles. They communicate through song and dance, and have a complex social life based on breeding pairs that mate for life. They usually raise one chick each year. And they tend to live long lives, averaging 25 years in the wild, with a few individuals reaching more than 70 in zoos.

Most cranes also migrate, and some migrate amazing distances. For instance, the endangered whooping crane (*Grus americana*) of North America flies to and from central Canada and the Gulf coast of Texas every year, about 2,400 miles each way, always returning to the same breeding and wintering grounds.

Aldo Leopold described the approach of migrating sandhill cranes (*Grus canadensis*) in his book *A Sand County Almanac*. At a distance they sound like "a tinkling of little bells," then as they get closer, like the "baying of some sweet-throated hound," and finally like "a pandemonium of trumpets, rattles, croaks and cries."

Vocalizations are an important aspect of crane biology. Biologists studying crane-talk have inferred the meaning of many of the varied vocalizations, although much of what scientists know about cranes comes from intensive studies on a few crane species. But it's taken years of field observations. "It's like any language," says Thompson. "It takes time."

Cranes often use what scientists refer to as the unison call. One member of a crane couple starts and the other answers.

They call back and forth for a few seconds to more than a minute. Cranes mate for life, and scientists believe the unison call plays an important part in mate selection, pair bonding, and social compatibility. "It's kind of like kissing in humans," says Thompson. No wonder the Japanese have long seen the crane as a symbol of marital fidelity and happiness.

Both the male and female help raise the young. They share the task of incubating the eggs and, once the chicks hatch, both parents feed, care for, and protect the young. The young birds fledge after two to three months, but the family remains together. At about nine months the parents drive off their adolescents as they prepare to nest again.

Pairs and families use a contact call to keep track of each other when they are out of visual contact or when they move within a large flock. In fact, cranes have a wide range of calls that indicate everything from an intention to take flight, to a warning for others to keep away.

In addition to their calls, cranes are admired for their elaborate displays, or "dances." The dance can be a prelude to copulation, or just a general indication of excitement, and is delightful to watch. At the Zoo, the wattled cranes (*Bugeranus carunculatus*) from Africa occasionally dance when their keeper feeds them in the morning. The birds crouch down and leap in the air, flapping their wings. Often they pick up twigs and flip them into the air as they jump.

Humans have incorporated some of the ritualized movements of cranes into their own dances. Aboriginal peoples in Australia and Asia, as well as the ancient Chinese, borrowed from crane "choreography." In most cases, the human dances celebrated the arrival of spring, fertility, longevity, and the afterlife, all of which were associated with cranes.

But for all their esteemed status, seven of the 15 crane species are endangered, and a few, such as the whooping crane and the Siberian crane (*Bugeranus leucogeranus*), are extremely so.

There are several reasons for the decline of cranes. Probably the most significant cause is habitat loss. Most cranes live around wetlands and use wetlands as stopover areas during migration. But people drain wetlands to build houses, or divert water from wetlands for agricultural uses, degrading



Demoiselle crane (*Anthropoides virgo*). (Jessie Cohen/NZP)

or destroying crane habitat. The unregulated hunting of cranes by humans represents another significant threat. Also, cranes reproduce slowly, so populations take a long time to recover from any decline in numbers.

To help preserve cranes, the Zoo participates in a national effort to breed certain species of endangered cranes. Through a formal agreement called a Species Survival Plan (SSP), the zoo populations of endangered red-crowned, white-naped (*Grus vipio*), and hooded (*Grus monachus*) cranes from Asia are each managed as a single population.

"It's a controlled breeding program to maximize genetic diversity," says Scott Derrickson, deputy associate director for Conservation at the Zoo's Conservation and Research Center in Front Royal, Virginia. "In the past, there has been no management. Some zoos bred the heck out of their birds, but all the offspring came out of one or two pairs." The SSPs coordinate the breeding of cranes, and the crane species involved in the program are doing well.

The National Zoo exhibits the sarus, red-crowned, demoiselle, sandhill, wattled, and white-naped cranes, as well as the blue (*Anthropoides paradisea*), and East African crowned cranes (*Balearica regulorum*), both from Africa.

Zoo visitors can follow the trumpeting behind the Bird House for an eye-to-eye encounter with a crane.

—Lisa Strong-Aufhauser

nam. It's the largest wetland reserve in the country and the only sizable wetland in the south," says Beilfuss. Support for the project came from the Brehm Fund for International Bird Conservation, the National Wildlife Federation, and the John D. and Catherine T. MacArthur Foundation.

When Beilfuss and Barzen first visited Tram Chim in 1989, the reserve protected the cranes but could not support them—the birds had to fly out during the day to find food. "When we arrived, Tram Chim was a reservoir with dikes that kept in rainwater and kept out river water. It was eroding and, although some native vegetation had returned, it was stressed out and decaying," recalls Beilfuss.

One of the keys to restoring Tram Chim was reestablishing its natural water cycle of

flooding and drainage. While the most natural way of restoring the Mekong River floodwaters to the reserve would have been to plug the drainage ditches, this was not an option because they have become major transportation arteries. Instead, Beilfuss and Barzen proposed installing gates that would control the flow of water into and out of the reserve.

Another key to restoring Tram Chim was buffering it from development. Originally, the Vietnamese had planned to develop all of the land surrounding the reserve by 1995, which would have turned it into "a small island in a sea of rice," wrote Barzen in a 1992 ICF newsletter. Despite its size, Tram Chim is not large enough to support healthy populations of all its species. For example, computer models predict that "cranes [will] go ex-

tinct if Tram Chim is the only breeding area [in Vietnam]," says Beilfuss.

To decrease the impact of development on the reserve, Beilfuss and Barzen proposed devoting a nearly 15,000-acre ring of land surrounding Tram Chim to uses compatible with wildlife conservation. Rear mangroves offer resources for people, as well as habitat for warblers and other forest songbirds and breeding rookeries for herons and other wading birds. Likewise, native reed marshes provide both grazing for water buffalo and habitat for cranes, storks, and other species of wading birds.

"In doing any restoration, you need to meet the needs of the local people. In a poor country like Vietnam, you can't say that this is an oasis for birds. You have to consider resources for the people," says Beilfuss.

Beilfuss and Barzen presented their plan for restoring Tram Chim to the Vietnamese in early 1991, hoping to reach consensus among the local people, scientists, and government officials. The language barrier during the negotiations was surmounted by Huong Norton Payson, a United States citizen who emigrated from Vietnam in 1965. She had been following the work of the International Crane Foundation for years and was eager to take an active role in restoring crane habitat in her native land.

Ditching Dividing Ditches

Overcoming the scientific barrier was more difficult. "The war cut off scientific communication between our countries, and disciplines like ecology that developed in the U.S. during the 1960s started later in Vietnam," says Beilfuss.

While most of the Vietnamese's concerns with the restoration plan were easily resolved, one was not: They wanted to dig four new ditches that would subdivide the larger portion of the reserve into quarters. In fact, they had already dug one of the ditches by the time they announced their intention to do so. "They wanted to create separate management units with different water levels within the reserve—one with high water for rear mangroves so they wouldn't burn (even though it's not as good for the trees), two with medium water for fisheries, and one with low water for grasslands and the birds," says Beilfuss.

Beilfuss and Barzen strongly opposed adding ditches to the reserve. "In the presence of so many unknowns, it seemed wise to pursue natural management as much as



Rear mangroves are beneficial to people as well as a variety of birds. (George Archibald/ICF)



Painted storks are among the many bird species protected within the reserve at Tram Chim. (George Archibald/ICF)

possible. A canal through the middle of the reserve would also divide a 15,000-acre area in half, increasing the amount of wetland exposed to disturbance. Species like the black-necked stork, which requires large areas of undisturbed habitat, might not survive,” wrote Barzen in the ICF newsletter.

Convincing the Vietnamese officials not to add the central ditches to the reserve could have been quite tricky. “The lack of good natural models for Tram Chim made it harder to justify many of the restoration steps we proposed to the Vietnamese,” says Beilfuss. Luckily, reserve founder Muoi Nhe had already visited the ICF headquarters and had seen the Horicon National Wildlife Refuge in eastern Wisconsin, which is divided by a central ditch constructed when the area was converted to agriculture in the 1890s. “The ditch routes water in and out very quickly, which shortens the wet season and lengthens the dry season,” says Beilfuss.

Having seen the drainage problems caused by central ditches firsthand, Muoi Nhe was able to help persuade the other Vietnamese on the team to at least delay digging the other three ditches. As Beilfuss and Barzen pointed out, they could always be added later if necessary.

Tram Chim, Past and Present

Once the Vietnamese–ICF team reached consensus on a plan, the restoration work began. The first steps in restoring an area are determining what it is like now and what it used to be like before being disrupted. Characterizing the current state of the disrupted area is necessary for understanding the effects of future restoration efforts. The restoration team analyzed the flow and quality of water in Tram Chim and cataloged the species living there. While the native flora and fauna in the reserve were sparse, they were quite diverse.

The restoration team found 130 species of plants and 181 species of birds in the reserve.

The existence of such a variety of life led the team to focus on fine-tuning their re-creation of the water cycle rather than on reintroducing missing species. Bringing back the water also brought back many of the plants because their seeds were lying dormant in the soil. The plants then attracted the animals that eat them.

Determining what Tram Chim was like before the war was more difficult. The restoration team was handicapped by the

The existence of such a variety of life led the team to focus on fine-tuning their re-creation of the water cycle rather than on reintroducing missing species. Bringing back the water also brought back many of the plants because their seeds were lying dormant in the soil. The plants then attracted the animals that eat them.

nearly complete destruction of the Plain of Reeds. “The restoration that we do in the U.S. is better understood because we have good natural models to mimic—this is not so in Vietnam,” says Beilfuss.

To learn what they could about the plain’s natural water cycle and the species that lived there before the war, the team studied pre-war climatic records and aerial photographs taken by the United States military. They also interviewed people who had lived in the area for a long time. Developing a preliminary model of the plain’s natural water cycle was relatively straightforward; “much of what we know about what [used to live] there is based on what has come back,” says Beilfuss.

After the background studies had been done, the physical restoration began. In 1991, four water gates were installed at points where large natural streams met the dikes surrounding the larger portion of the reserve. The six-by-six-foot gates are kept closed when the rainy season begins in late April to early May, which keeps out the acidic, sediment-laden water from the ditches surrounding the reserve. The gates are opened sometime between June and August, when the nutrient-bearing overland floodwaters from the Mekong River reach the reserve. The gates are closed again in December, after the rainy season ends and the water in the reserve has receded to the prewar dry-season level.

An Australian Model

To learn more about what the restoration

team should be working toward, Beilfuss and Barzen searched for other wetlands similar to the Vietnamese portion of the Plain of Reeds. Unfortunately, they found that the Cambodian portion of the plain differs greatly from the Vietnamese portion. In Cambodia, the plain lacks acid soil and floods much deeper and longer, which excludes many of the species found in Tram Chim.

Happily, at a 1992 international wetlands conference, Beilfuss learned of a good, relatively undisturbed match in Australia: Kakadu National Park, which is part of the Magela Creek Wetlands in the Alligator Rivers region of the Northwest Territory. Both Tram Chim and Kakadu National Park flood seasonally and have acid-sulfate soil. In addition, “the Australian wetland has most of the same plant communities and many of the same birds [as Tram Chim],” says Beilfuss. “Its latitude is 12 degrees south and Tram Chim’s is 12 degrees north.”

Besides having similar ecologies, the two wetlands share management problems such as how to control water buffalo grazing, how to mimic natural fires (which are necessary to wetland ecology) with prescribed burns, and how to eradicate aggressive nonnative plants.

“We’ll be taking the Vietnamese to Kakadu National Park soon to learn more about this ecosystem. It may turn out to be a real blessing—the Australian wetland is carefully and effectively managed,” says Beilfuss. Seeing Kakadu National Park could help convince the Vietnamese of the importance of management.



Boat traveling on Vietnam War-era drainage ditch. (Jeb Barzen/ICF)

Ongoing management is essential to Tram Chim’s success. Thus, Beilfuss and Barzen are working with the Vietnamese to monitor and evaluate the effects of their restoration strategies. By monitoring the quality and flow of water through the reserve, for instance, the Vietnamese will be able to assess how close they have come to re-creating the wetland’s prewar conditions. Similarly, ecological studies may lead the Vietnamese to fine-tune their restoration plans to focus on additional rare species. “We’ve focused on birds because there aren’t many mammals there now,” says Beilfuss. “Later we will get to the stage where we look into other animals more.”

Wetland restoration is not always successful and preserving natural areas is preferable to restoring them. “Many ecosystems such as estuaries and meadows simply cannot be re-created,” says Beilfuss. “Even in Tram Chim, we’ll never get back what was there before. It’s just a question of will we get 50 percent? 25 percent?”

These caveats notwithstanding, so far Tram Chim is a success story. This spring, for the first time, the eastern sarus cranes were able to find enough food to support themselves within the reserve. And, besides the cranes, two other birds thought to have been extinct in Southeast Asia have returned: the Bengal florican (*Eupodotis bengalensis*) and the black-necked stork (*Xenorhynchus asiaticus*). Several other species of storks have also returned and common waterfowl such as egrets and teal abound. And the future continues to look bright for Tram Chim. “It should be officially designated a national park by the end of the year,” says Beilfuss. ♣

Robin Meadows is a contributing editor to ZooGoer.



Fishing at Tram Chim. (Brehm Fund for International Bird Conservation)

The Area Scene

Although the periodic, or 17-year, cicadas that transformed the Washington area into a particularly loud insect airport a few years back will not return until 2004, other species of cicada are currently sounding-off. Cicadas are large insects, one- to two-inches long, with transparent wings and bulging eyes. They live in trees, so are often heard but not seen. With a built-in, muscle-powered clicker on the underside of the abdomen, male cicadas make a rapid buzzing sound to attract females. The sound of summer, the whir of cicadas should last through August.

The Good News...

The known world population of Mediterranean monk seals (*Monachus monachus*) recently doubled when a Spanish expedition discovered 350 of these highly endangered seals living off the Atlantic coast of war-ravaged Western Sahara. Once widely distributed in the Mediterranean Sea as well as in the Black, Aegean, and Adriatic seas and along the Atlantic coast of North Africa, these monk seals were thought to number only about 300 animals in 1988: 200 in the Aegean and 100 off the North African coast.

Years of conflict among Morocco, Mauritania, and the Polisario Front in this former Spanish colony may actually have contributed to the monk seals' survival. Restricted access to disputed coastal waters and attacks on

fishing boats, which scared off fishermen, created a food-rich, undisturbed haven for the fish-eating seals.

From New Scientist, April 3, 1993.

The Bad News...

A compelling reason for conserving plants and animals is each species' unique potential for offering new cures or better treatments for human diseases. But a controversial claim that crushed shark cartilage cures cancer may doom the 11 shark species that live in the coastal waters of Costa Rica.

Although no scientific evidence supports this claim, cancer patients in the United States and in Western Europe are paying dearly for shark cartilage pills. To meet the growing demand, one Costa Rican company's monthly production of dried and crushed cartilage is expected to reach 22,500 pounds by the end of this year. Shark has become a highly profitable catch for fishermen—a single boat may bring in 11,000 pounds on a good day.

The Costa Rican shark population, which is also threatened by the lucrative Asian market for shark fin, is collapsing, and scientists aren't sure how much longer sharks can withstand the pressure. Ecologists worry that the loss of this top predator could profoundly change the complex web of ocean life.

From Tropical Conservation Newsbureau, April 26, 1993.

What's In a Name

Eight of the 15 species of cranes share the genus *Grus*, from the Latin *grues*, an onomatopoeic rendering of the cranes' grunting calls. The ancients found the cooperative, coordinated behavior of cranes so compelling that a Latin word meaning to agree, *congruere* (and from the Latin, the English word congruence), is based on the word for crane.

Some of the species names for cranes describe, somewhat prosaically, geographical distribution (*Grus japonensis*, the red-crowned, or Japanese, crane) or color (*G. nigricollis*, the black-necked crane). But cranes seem often to have evoked more poetic associations. Linnaeus, for instance, called the sarus crane *Grus antigone*: This crane's bare neck suggested the daughter of Oedipus, who hung herself after she was sentenced to death for defying Creon's order to leave her brother unburied. And the hooded crane's name is *G. monachus*, from the Latin for monks. The white hood and dark-gray body of this species is reminiscent of the white hood and dark robes worn by monks.

Seeing the Light

Lighting accounts for about 10 percent of the electricity used in the average U.S. home. Replacing regular incandescent bulbs with compact fluorescent bulbs can reduce that energy demand by 75 percent.

A 27-watt compact fluorescent bulb can replace a

100-watt incandescent, while providing the same lumens of light. Besides being more efficient, compact fluorescents last longer—about 10,000 hours compared to about 750 hours for incandescents.

Using compact fluorescents saves energy and money. Although the compact fluorescent bulbs cost more up front (about \$25 per bulb), they save energy and replacement costs in the long run.

Urban Animal Safari

The Washington metropolitan area provides ideal habitat for a variety of wild animal artistic creations. These lively, if inanimate, creatures range all over the region, from our most famous public places to the most secluded private lairs. Pictured here is one of these fantastic animals—do you know where to spot it? (Look for the answer in our November/December issue.) Answer to the May/June Urban Animal Safari: Private residence, Woodley Park, Washington, D.C.



(Christy Bowe)

The Ninemile Wolves.

1992. Rick Bass.

Clark City Press,

Livingston, Montana.

166 pp. hardbound, \$22.95.

In a 60-year war against wolves, waged with seemingly maniacal fury, people finally succeeded in eliminating the animals in the western United States. Between 1870 and 1942, when the war ended, hundreds of thousands of wolves were killed—poisoned, shot, trapped, even burned alive—in Montana alone. For the next 60 years, no wolves dared return, although wolves lived in sizable

numbers just over the border in Canada.

Recently, however, wolves have cautiously infiltrated their former haunts, testing the waters in Washington's North Cascades National Park and Montana's Glacier National Park. And a few wolves have moved beyond these protected parks on the border, into the human- and cattle-dominated valleys of northwest Montana. In *The Ninemile Wolves*, author Rick Bass tells the story of a pack of these pioneering wolves.

In the spring of 1989, a female wolf, presumably from Canada, gave birth to

three pups in northeastern Montana's Pleasant Valley, near the village of Marion. Two adult males were also found in the valley. One of these males was shot in April 1989, and the other died after the Pleasant Valley wolves were relocated to Glacier National Park in the fall. Their relocation was precipitated by the fear that the wolves would kill cattle and sheep, and the unproven allegation that they had already done so. Two of the pups died—starved to death—after the relocation. The third pup was shot in the spring of 1990.

The adult female, known as the Marion wolf, was determined, however, to choose her own home farther south. She fled from Glacier to Ninemile Valley, where she found a lone male wolf and, in the spring of 1990, gave birth to six pups. In June of that year, some unknown person shot her. The male, however, continued to care for the pups through the summer—until he was hit by a car in September. Montana is not kind to wolves.

The bulk of *The Ninemile Wolves* details the fate of these orphaned cubs and the heroic efforts of U.S. Fish & Wildlife Service biologists to save them, and to save them as wild animals with a healthy fear of people. But Bass's story is not just about wolves. It couldn't be. These wolves, perhaps all wolves, exist in a tangled web of people and politics, myth and reality, love and hate, past and future. Bass brilliantly explores this web, tries to tease apart the tangles, and makes a passionate case for what he perceives as wolves' moral right to reclaim their heritage.

Bass is a wolf partisan, which in Montana is primarily a political position. The issue of the natural return of wolves to Montana, as well as the planned reintroduction of wolves to Yellowstone National Park, polarizes Montana like the abortion issue polarizes the nation. As Bass reports, a 1990 survey found that two-thirds of Montanans think wolves should be allowed to return to the state. But the third that disagrees is a vocal and powerful third: some



Female gray wolf in winter. (Rick McIntyre)

hunters and cattle ranchers and their elected representatives, one of whom likens wolves to “cockroaches in your attic.”

Bass is blistering in his contempt for the anti-wolf faction, in particular a minority of hunters and their supporters in the state wildlife agencies who fear that a few wolves will devastate the wildlife and take away their “hunting opportunities.” Although a hunter himself, Bass describes state game and fish politics as “the politics of deer and elk availability to lard-ass hunters with no concept of simple biology but a healthy fear that wolves might compete with their high-powered scopes and 2900-feet-per-second bullets.” Ironically, it was the deer that “slob hunters” (Bass’s term) crippled and didn’t bother to track down and kill that sustained the orphaned wolf pups through their first autumn.

Bass extends more sympathy to ranchers, whom he believes are mellowing toward wolves, learning to accept losing a few cows—if they are compensated for them. In

fact, the Ninemile wolves were born and raised on the land of two old cattle ranchers who positively doted on them. Nonetheless, some ranchers would just as soon shoot wolves on sight, dead cows or no dead cows.

On the other side, Bass has nothing but admiration for “the feds”—the Fish & Wildlife Service biologists involved with the Ninemile wolves and the Ninemile people—and was dismayed when they were reassigned to an office hundreds of miles away. Says Bass, “Things were done perfectly in the Ninemile—the feds could not have done a better job—and I think it would have been a fine thing, for wolves and everyone, to have the feds continue their presence there to serve as . . . an example of the truth of wolves and humans, versus the myths.”

And, of course, Bass loves wolves, about which he is unabashedly anthropomorphic. He talks of the passion of wolves, their spirit, their mystique, and believes that even biologists, hearing the howling of a wolf on a cold dark night, “anthropomor-



Male gray wolf. (Rick McIntyre)

phize like mad.” In talking about how wolves take prey, he says, “The wolves swarm [the floundering prey]. They don’t have thumbs. All they’ve got is teeth, long legs, and—I have to say this—great hearts.”

It’s hard not to agree with him. The irony of wolves making their own way back into Montana, setting up household a stone’s throw (for an animal that covers twenty miles in a night’s hunt) from Yellowstone, while the biologists and politicians were fighting over

reintroducing wolves to the park, is delicious. After a 60-year absence, just as the reintroduction program is about to become reality, the wolves are reintroducing themselves.

Biologists attribute the wolves’ return to an extraordinary increase in the number of deer in recent years. But one can also imagine the wolves *deciding* to control their own destiny, spurning our well-meaning offer of assistance, and striving to reach the promised land of Yellowstone not owing us a thing.

—Susan Lumpkin

Art in the Park

Renowned wildlife artist Charles Frace will be at the Zoo on Saturday, August 21, and Sunday, August 22, from 11:00 a.m. to 6:00 p.m., to exhibit his work and talk to Zoo visitors about his art and his passionate commitment to conserving the wildlife his art portrays. The exhibit features seven of Mr. Frace's latest prints—stunning images of such majestic creatures as black bears and mountain lions.

The prints will be available for purchase, as will a poster, *The American Wildlife Image*, in both a collector's and popular-price edition, and the book *Nature's Window: Charles Frace*, a comprehensive presentation of the artist's work, with beautiful, full-color reproductions of his most significant paintings. For a \$10.00 donation to FONZ, Mr. Frace will sign any purchase.

This is a unique opportunity to meet a man acclaimed as America's greatest living

painter of animals. The exhibit will be outdoors in Panda Plaza. For more information, please call 202.673.4717.

Watching and Wondering

Watching and Wondering: The Life and Work of Niko Tinbergen, a small exhibit about one of the founders and most brilliant practitioners of the science of ethology (animal behavior), is on display in the lobby of the Zoo's Education Building.

In a career that spanned more than 50 years, Tinbergen (1907–1988) studied behavior in diverse species from hunting wasps and butterflies to stickleback fish and herring gulls. His greatest contribution was in transforming the study of animal behavior into a rigorous science. He received the 1973 Nobel Prize in Physiology or Medicine for his work, an honor he shared with Konrad Lorenz and Karl von Frisch, also towering figures in the history of animal behavior research.

Zoo Director Michael Robinson, who studied under Tinbergen at Oxford University, says "Here was a man whose like we shall never see again, a rare genius and magnificent mentor. We cannot do him justice but I hope you will come and catch a glimpse of the Maestro in this exhibit."

Cohosted by the Oxford Society of Washington, D.C., the exhibit is on loan from the University of Oxford's University Museum and its Department of Zoology. It will be on display at the Zoo until March, 1994.

Annual Report

The 1992 Annual Report, which summarizes all of FONZ's diverse activities and achievements in that year, is now available. If you would like a copy of the report, please write to: FONZ Annual Report, Communications Office, Friends of the National Zoo, National Zoological Park, Washington, D.C. 20008.

Sumatran Tigers Born

The Zoo's female Sumatran tiger, Kerinci, gave birth to two cubs on June 14, very welcome additions to the zoo population of this endangered species. Only about 500 tigers survive on the island of Sumatra and fewer than 200 Sumatran tigers live in zoos worldwide.

The National Zoo participates in the Sumatran tiger Species Survival Plan (SSP), in which zoos throughout

North America are cooperating to develop a large and genetically diverse tiger population. Kerinci's young are particularly valuable to this effort. She is one of four Sumatran tigers brought to the U.S. from Indonesia four years ago specifically to increase genetic diversity of the North American zoo population. The new cubs, both males, are Kerinci's second litter; her first, a male and a female, was born in March 1992. The cubs will make their public debut at the end of August.

Menagerie Masquerade

Mark your calendar for *Menagerie Masquerade*, FONZ's first annual fall gala fundraiser on Saturday, October 30, from 8:00 p.m. to midnight. The costume ball will feature musical entertainment, dancing, and fine food and beverages. Prizes will be awarded for the best costumes, but costumes are optional. Proceeds will go toward conservation education programs at the Zoo. Tickets are \$30 for FONZ members and \$35 for the general public. Look for details in an upcoming issue of *Wildlife Adventures*, or call 202.332.WILD for information and to reserve tickets.

Other Upcoming Events

- Saturday, September 18: Hispanic Heritage Day at the Zoo.
- Friday, October 15: FONZ Annual Meeting and Zoo-by-Night Tour.



Family Ties, by Charles Frace.

REFRESH
YOUR
SENSES.



Don't miss
MENAGERIE MASQUERADE
*FONZ's First Annual
Costume Ball*

October 30, 1993

(See page 30 for details.)

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